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Embolism of the Central Artery of the Retina, with the Report of Three Cases.

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EMBOLISM OF THE CENTRAL ARTERY OF THE RETINA, WITH THE REPORT OF THREE CASES.

BY G. E. DE SCHWEINITZ, M.D.,
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Since 1859, when Von Graefe observed the first case in which there was almost instantaneous blindness from obstruction to the central retinal artery, until the present time, a great number of examples of this condition have been placed upon record. In 1885, Schnabel and Sachs (*Archives of Ophthalmology*, Vol. xiv, p. 298) were able to refer to 102 cases published to date, and in the years which have followed at least 32 additional instances have been added to the literature of medicine. Indeed, the entire subject has recently been reviewed in great detail in an elaborate monograph by R. Fisher, "Ueber die Embolie der Arteria Centralis Retinæ," Leipzig, 1891. In spite of these records, the explanation of certain phenomena seen in connection with this accident remains in dispute, and each new carefully observed case contains elements of interest worthy of publication, either because it places at our disposal ad-

ditional facts, or because it tends to confirm former observations.

Case 1.—Embolism of the Left Central Artery of the Retina. Ophthalmoscopic Examination Twenty Minutes after the Obstruction, April 7, 1891. C. R., a man aged 26, while standing on the street conversing with a friend, without premonition, was suddenly completely blind in the left eye. The absolute character of the loss of vision is attested by the fact that after closure of his unaffected eye, he was unable to perceive the faintest ray of light from an electric lamp situated directly opposite to him. He came almost at once to my office and was examined (10:20 P.M.) twenty minutes after the occurrence. He was pale, complained of a feeling of faintness and vertigo, the pulse was 75, rather strong and bounding, and there was a coarse mitral systolic murmur transmitted to the axilla. Vision in O. D. $\frac{6}{6}$; in O. S. *nil.* The pupils were equal in size, the left unaffected by light, but acting consensually with the other. *Ophthalmoscope.* The oval optic disc, superficially pinkish-gray in tint, but distinctly pallid in its deeper layers, was surrounded by a partially absorbed choroid ring, within which the connective tissue ring could be traced all round. The coloring of the disc was visible through a semi-transparent, delicate haze which covered its surface and spread out into the retina in a circular area of about a disc's diameter; here the color of the haze was more decidedly gray. The macular region was invested with a similar, but more milky haze, and in the centre there was a typical *cherry spot.* These two banks of fog were separated by an area of unaffected retina. The entire arterial tree had very much dwindled, the vessels being represented by faint, rosy threads on which no light reflex could be traced. There was no anomalous vessel. The shrinking of the arteries perceptibly increased during the ophthalmoscopic examination. In contrast, the veins seemed larger, although as compared with the other side, they were smaller than normal. In the lower temporal vein a moderately rapid circulation was visible, characterized by small cylinders of blood separated by clear spaces which moved towards the disc, giving very much the appearance that would be produced by mixing air and colored water in a tube. Rapid and vigorous massage of the eyeball produced no effect upon the embolus and no material change in the ophthalmoscopic appearances, and a current of blood was not developed in the arteries by this manipulation. The ophthalmoscopic examination, which lasted for ten or fifteen minutes, was abruptly terminated because the patient

fainted, or at least became so faint that he could not sit upright.

April 8, 1891. The patient was seen at his house under circumstances that made a prolonged examination with the

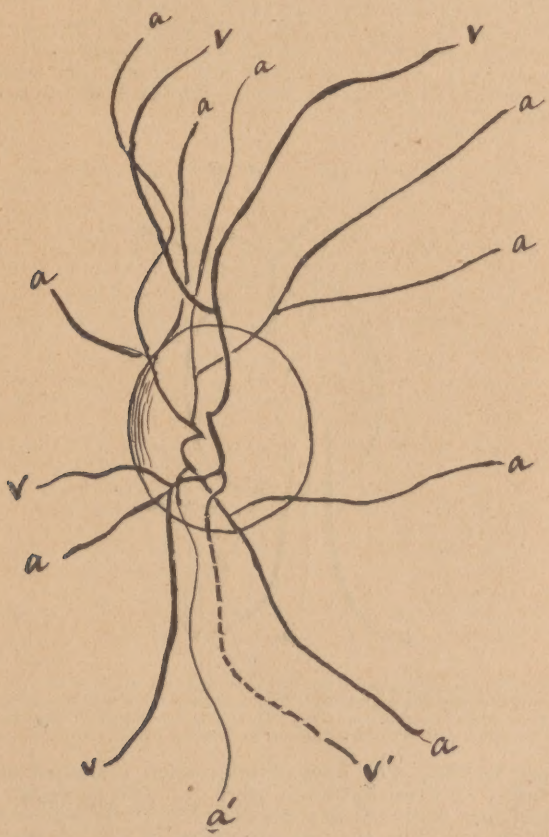


FIGURE 1.—Representing the retinal veins and arteries after the primary shrinking had given place to increase in diameter; a, artery; v, vein; a', artery which remained small; v', vein which exhibited beaded circulation. No attempt has been made to show the œdema.

ophthalmoscope well nigh impossible. The chief change which had taken place was the deepening of the milky-white infiltration of the retina. The cherry spot remained as before, the arteries were still small, but not so small as on the previous day, and the beaded circulation in the vein had ceased. There was now faint light perception.

April 10, 1891. The disc was quite pallid, in fact, it was materially obscured by the deepened milky infiltration, the peri-papillary portion of which had joined the macular bank, so that there was no intervening layer of unaffected retina.

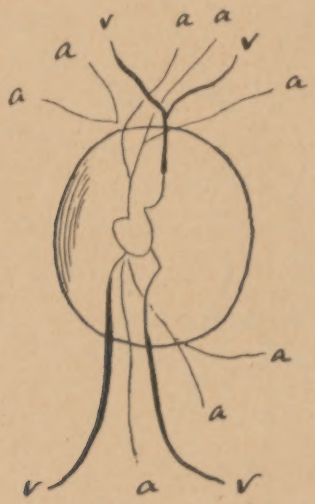


FIGURE 2.—Representing the retinal veins and arteries 35 days after the occurrence of the embolism. The arteries are mere threads, and are lost soon after crossing the disc. The veins are dark and large in contrast, except in the venous circle on the disc; a, artery; v, vein.

April 20, 1891. The area of infiltration remained about the same. The retinal veins were full, and of apparently normal size, while the arteries had materially increased in diameter, and, with the single exception of the inferior temporal artery (which was only a faint thread), could be traced for some distance out into the retina, but were finally lost in the foggy infiltration. (See Fig. 1.) The light perception

in the centre of the field was a little more marked. The patient was not seen after this for nearly a month.

May 12, 1891. The oval optic disc was of a greenish pallor, entirely devoid of capillaries. All the arteries were faint threads scarcely distinguishable upon the disc, and lost entirely, or traceable only as minute whitish lines, after they had passed the margin for less than half a disc's diameter. (Fig. 2.) The veins were also shrunken, but in contrast to the arteries appeared darker than normal. The fog-like infiltration previously described had entirely disappeared, while in the macula was clustered quite a mass of cholesterin crystals. There was not the faintest ray of light perception.

Further data in regard to the clinical history of this patient and his previous cardiac conditions are contained in the following letter received from his physician, Dr. William Pepper: "The cardiac lesion in C. R.'s case evidently dates back a number of years. I was first consulted about it in 1887, when I found a marked mitral regurgitation with a strong systolic murmur and a moderate degree of hypertrophy, not more than enough to effect good compensation. This condition has continued to the present time. He has been subjected to a great deal of care and physical, mental and emotional strain. The heart has borne it fairly well. During this winter there was some increasing anæmia, with a strong tendency to rapid action of the heart and to general weakness of the system. There was also slight feverishness from time to time. This was much improved by complete rest for short periods. In the summer of 1890, when in a location quite free from malaria, he had a series of severe chills, followed by a high fever of short duration. There has been a slight return of this during the present month, May, 1891. Are these truly malarial, or can they be connected with slight points of ulceration which might favor the detachment of a fragment of vegetation? In favor of the malarial view is the fact that the chills have yielded promptly to full doses of quinine."

Some time after the embolism, or in the early summer of 1891, this patient developed a popliteal aneurism, for the cure of which he finally underwent the operation of ligation of the femoral. Afterwards an aneurism appeared in the course of the brachial artery. Preceding the development of these aneurisms, he had an attack of rheumatic fever, or at least an attack which was thus diagnosticated.

Remarks.—The sudden onset of the blindness, the classical symptoms of acute anæmia of the retina

from obstruction of the central artery, and the cardiac and vascular disease in this patient, render it more than probable that the lesion was an embolus. Some interest attaches to the opportunity of observing the ophthalmoscopic changes so soon after the lodgment of the obstructing body. The picture did not materially differ from that which has often been described, but it is interesting to note how rapidly the œdematous change may occur in the retina after it has been deprived of its blood supply. The formation of two areas of infiltration separated by a band of comparatively unaffected tissue, is not readily explained, unless it be assumed that this region was not deprived of its blood supply.

The second point of interest in this case is one that has been noted in other instances, namely, that although the primary effect was to obliterate vision absolutely, and that at first the retinal arteries dwindled away to mere threads, after a time, beginning about seventeen hours after the lodgment of the embolus, the arteries increased in size, and so long as twelve days afterwards, with the exception of the inferior temporal artery, remained of considerable magnitude. During this period of the increase in the size of the vessels, there was faint light perception; in fact, on the day immediately following the accident, the patient declared that he could tell an object passed in front of his eye. Gradually, however, this return of sight disappeared, the arteries shrank, and the eye became absolutely blind.

Schnabel and Sachs have dwelt considerably upon this point, and enforced their observations with one

autopsy. According to them, after a *partial* embolism of the trunk of the central artery, there are two causes which interrupt the circulation: one is the embolus itself, and the other is the spasmodic contraction of the walls of the artery. The latter gradually disappears, and then the vessels become filled again without there having been any change in the character of the embolus itself. The ultimate deterioration of vision, or its complete loss, depends upon the fact that there is no change in the position of the embolus. These observers believe that there is only one symptom which will decide whether an embolus partially or completely obstructs the flow of blood. It is partial if there is fulness of the vessels, or if there is circulation of the blood as indicated by the movement of the blood in the right direction seen after the embolism has occurred. The presence or absence of vision is of secondary importance in this respect.

Case 2.—Embolism of the Right Central Artery of the Retina. Examination Five Months after the Accident. Partial Preservation of the Temporal Field of Vision. S. H., a man aged 72 years, presented himself for examination October 22, 1890, with the following history: In May, 1890, when feeling perfectly well, with no premonitory symptoms, and while standing at his dressing case in the morning, he suddenly appreciated that the sight of the right eye was blotted out. No exact data are at hand from which to decide the completeness of the loss of vision, but from his own account and from that of his most intelligent family physician, it is probable, for many hours at least, that the obliteration was absolute. No one was at hand to make an ophthalmoscopic examination, but the patient was put to bed, purged, given sedatives, and his temple was leeched. After a time he began to see slightly, but did not find it convenient to consult any one until the date just mentioned.

He had always been a healthy man until about the time of the embolus, when his doctor discovered some sugar in

the urine. This appears to have been a temporary condition, and when I examined him there was neither sugar, albumin, nor tube casts. There was high arterial tension; the temporal and radial arteries were distinctly hard to the touch. There was no increase in the area of cardiac dulness; the first sound was somewhat muffled and the second sound clanging. There was no murmur.

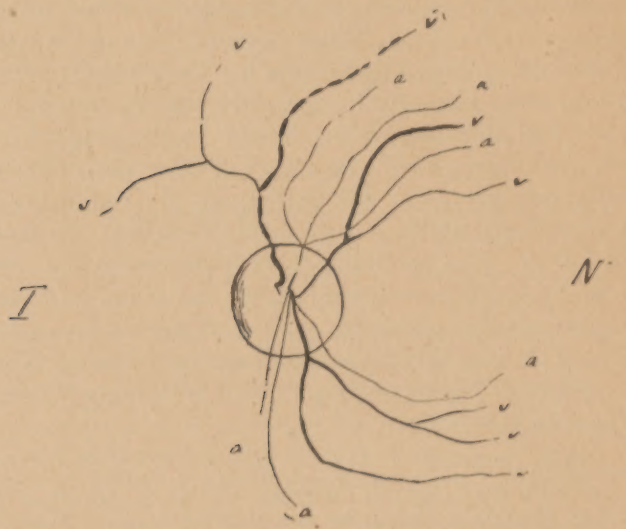


FIGURE 2.—a, artery; v, vein; v', beaded vein. A diagrammatic sketch. No vessel passes to the temporal side, and fine, transverse branches are absent. T, temporal side; N, nasal side.

Ophthalmoscope. The optic disc was nearly round, entirely atrophic, being of a greenish-white color. The arteries, where they could be traced, were mere threads, and none could be followed to the temporal side. The veins in contrast were dark, and the upper temporal vein, or at least the main branch of it, was beaded, dark, well filled portions being divided from each other by entirely collapsed areas. The finer tranverse branches could not be seen anywhere. (Fig. 3.) The vision in this eye consisted in object perception in the temporal portion of the field. In the left eye the vision, after correction of a slight astigmatism against the rule, was $6 \div 6$. There were faint opacities

in the anterior cortex of the lens, an oval, normally colored optic disc, and no changes in the central circulation.

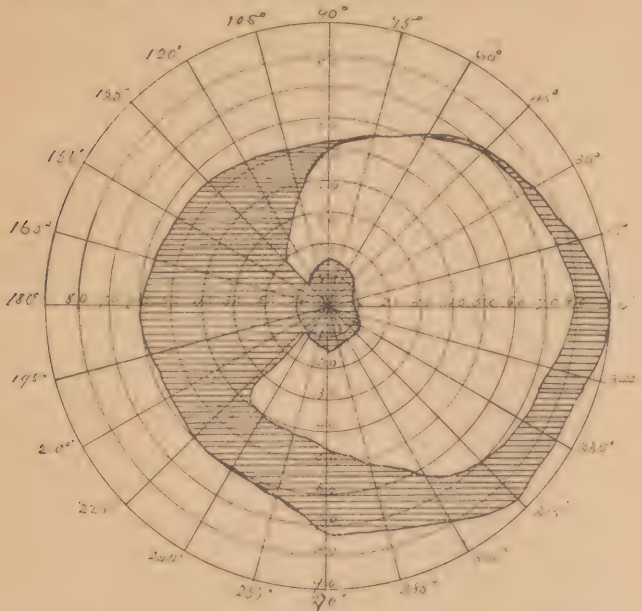


FIGURE 4.—Diagram of the field of vision of Case 2. The shaded area represents where vision was lost; the unshaded area, where there was preservation of form-sense.

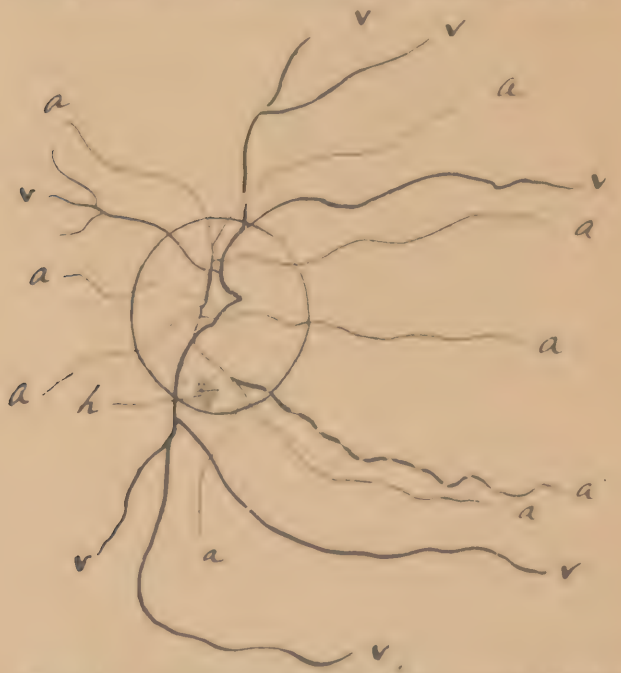
The field of vision of the affected eye is represented in the diagram. (Fig. 4.) The shaded portion indicates the area in which vision was lost and the white portion the preserved field.

It will thus be seen that the greater portion of the nasal field is wanting, and that the centre of the field of vision is sharply cut out by an area thirty degrees in its long diameter, which on the nasal side joins the general obliteration of the inner portion of the field of vision. In the area of preserved vision light-sense and form-sense remained; color-sense was wanting.

Remarks.—The case which follows has many fea

tures analogous to those in the one just reported: indeed, it may be looked upon as a study of the symptoms which were probably present in the early stage of the affection in Case 2. For this reason I will defer the remarks until I have quoted Case 3.

Case 3.—Embolism of the Left Central Artery of the Retina. Examination Fifteen Hours after the Accident. Preservation of a Small Part of the Temporal Field. Mrs. E. E., aged 68, pre-



hemorrhage in the disc.

sented herself for examination, May 1, 1895, at about 2 o'clock in the afternoon. Fifteen hours before she appreciated

that she had suddenly become blind in the left eye. There was a slight aura preceding the extinguishment of sight, characterized by what the patient called a "glimmering before the eye", probably some form of photopsy. The patient was in good health, had suffered no recent illness, but had done a good deal of stooping on the previous day, particularly in the act of gardening.

When examined the vision amounted to faint light perception in a small area of the temporal half of the field. The optic disc was oval, distinctly gray or gray-red in color; all of the arteries were subnormal in size, but of a fairly normal color, with the single exception of a large branch of the inferior temporal artery, which, from its point of origin from the main trunk near the lower margin of the disc, as far as it could be followed in its curve along the lower temporal retina, was beaded, and appeared as if a series of constrictions had been placed around it. Moreover, in contrast to all of the other arteries, it carried much more darkly colored blood, so much so that at the first examination it was thought to be a vein. (Fig. 5.) There was a faint milky haze, most marked between the macula and the disc, and the fovea was represented by a dull, brownish-red spot showing through the fog. There was a small haemorrhage on the disc lying between the inferior temporal artery and vein.

May 2, 1892. A careful map of the field of vision was obtained with the result which is exhibited in the diagram. (Fig. 6.) It will be observed that a small patch remains upon the temporal side, and that the centre of the field of vision is sharply cut out, in fact, that the general appearance of the map is closely similar to the one obtained in the previous case. In the area of preserved field light-sense remained, but form-sense and color-sense were absent. The ophthalmoscopic appearances were about the same as on the previous day.

May 16, 1892. It is unnecessary to give the daily record of the ophthalmoscopic appearances in this case; suffice it to say that gradually the haze disappeared and the disc became more and more atrophic. Today the following note was made: Disc uniformly gray and devoid of finer capillaries; only one small macular branch visible and one small vessel on the nasal side of the papilla; the veins are about the same size as the arteries, in fact, the upper temporal veins are smaller than the arteries, but both systems are diminished in size. The beading of the lower temporal artery continues. The haemorrhage on the disc has been absorbed.

May 24, 1892. Still greater atrophy of the disc. The upper

temporal artery for about a disc's diameter above the papilla is obliterated, and then continues as a fine thread. The other vessels are about the same.

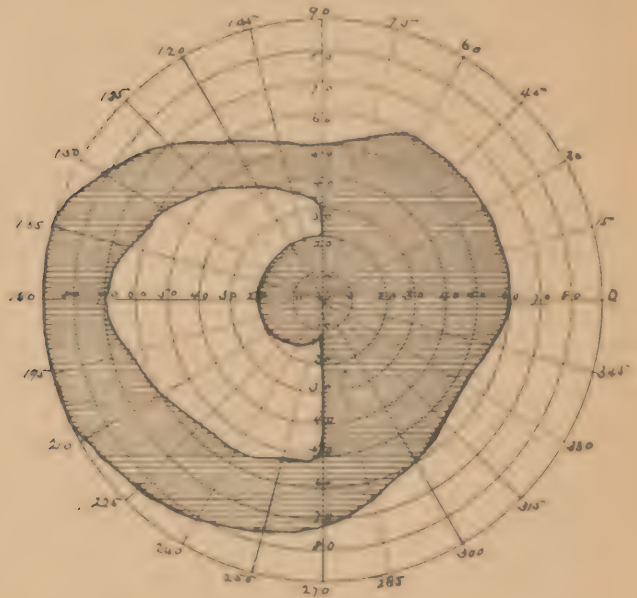


FIGURE 6.—Diagram of the field of vision in Case 3. The shaded area represents where vision was lost; the unshaded area, where there was preservation of light-sense.

The family physician, Dr. James B. Walker, has kindly reported upon the condition of the heart as follows: "An enlarged left ventricle, with atheromatous vessels, but without marked valvular lesion." The urine, of a specific gravity of 1022, was free from albumin and sugar. At the last visit, on May 24, the preservation of the small patch of vision upon the temporal side continued.

Remarks.—In Case 2 the diagnosis of embolism, in contradistinction to thrombosis of the artery, is not

quite so clear as in the first case which was reported, but may fairly be assumed to have been the lesion on account of the absence of a previous attack of temporary blindness in the affected eye, a simultaneous attack of temporary blindness in the unaffected eye, and giddiness, faintness, or vertigo—symptoms which Priestly Smith has taught to be somewhat diagnostic of thrombosis. In addition to the curiously constricted appearance of the upper temporal vein, the interesting feature of this case resides in the map of the field of vision, and the preservation of an area upon the temporal side in which form-sense remained.

In Case 3 there is some question between embolism and thrombosis, as the patient's general condition was such that the latter lesion might readily have formed. However, the usual ophthalmoscopic signs of embolism were present, and those which have been supposed to indicate thrombosis were absent. Small hæmorrhages along the course of the vessels have been noted in embolism; indeed, in one instance recorded by Knapp (*Archives of Ophthalmology and Otology*, Vol. I) there was extensive infarctus. A hæmorrhage upon the surface of the disc is, perhaps, more uncommon.

The dark color of the inferior temporal artery, so that the hue resembled that of venous blood, probably indicated slowness of the circulation. This phenomenon has been noted by V. Jaeger, Schneller, and is referred to by Schnabel and Sachs. In Schneller's case the arteries for some time had the appearance of narrow retinal veins.

The chart of the field of vision in this case closely resembles that of the former example. In each there was an almost exactly similar patch of the temporal field, in which in the one, form-sense, and in the other, light-sense was retained. In a number of instances of embolism, presumably of the central trunk of the artery, an eccentric (temporal) patch of the visual field has remained unobliterated, moreover, in the absence of any visible cilio-retinal vessel. Fischer, who discusses this phenomenon at some length, suggests several explanations. In his own patient, a portion of the retina which surrounded the papilla like a girdle retained its sensitiveness to light, and, according to this author, owed this preservation of function to a slight blood supply from ciliary vessels through the smallest cilio-retinal branches. It is possible the same explanation is applicable to cases in which the area of retained vision (light-sense or form-sense) occupied a larger portion of the nasal retina and caused the partial preservation of the temporal field.

Another explanation, discussed by Fischer, is that the diminished flow of blood in the central vessels after embolism is less marked in the areas near the papilla than in the more remote sections of the retina. In other words, it is assumed that all portions of the retina do not suffer equally from the diminished supply of blood, and that a portion of the nasal retina in part retains its functions. In a case of so-called hæmorrhage into the optic nerve observed by Magnus, fourteen days after the sudden blindness the patient began to see in the outer side

The exterior half of the retina and the macula remained blind. Magnus considered this condition of differential diagnostic import between embolism of the central artery of the retina and hæmorrhage into the optic nerve, and on the strength of it excluded embolism. Fischer, who quotes this case, is not in accord with Magnus as to the value of this point.

In Case 3, there was no apparent difference in size of the vessels passing to the nasal and the temporal side of the retina to account for the retention of a patch of functionally active retina. In Case 2, no small transverse branch was to be seen, and no vessel passed to the temporal side of the retina. Probably, as Fischer admits, neither of the theories which have been suggested is satisfactory, and we are not in position to explain the reason why a part of the nasal retina retains, partially at least, its function. Evidently, in some manner the blood supply of this portion of the retina is not so decidedly obliterated as elsewhere, or else by a collateral circulation it receives nourishment, although in an imperfect manner.

Discussion.

Dr. Edward Jackson, Philadelphia:—As bearing upon the question of embolism or thrombosis, I have in mind a case in which the history pointed toward the latter. A young man otherwise apparently healthy, gave a clear history of repeated attacks of impairment of vision in the affected eye. These attacks had occurred for some years, at first at long intervals, then more frequently. The final attack occurred on a Sunday morning while he was reading the newspaper. He said the sensation was exactly similar to that experienced on former occasions. He stopped reading and sat for a few minutes waiting for it to pass off but the trouble did not pass off; and instead, vision rapidly grew worse until

light perception was lost. I saw him twenty-two hours after the occurrence of the trouble. Light perception was then entirely lost. Œdema of the retina was very marked. The margins of the disc were obscured and the retinal veins contracted irregularly. There was no movement of the column of blood. The arteries were not materially altered in appearance. The patient subsequently remained in good health until the occurrence of an attack of typhoid fever from which he died.

As bearing upon a point in reference to Dr. Ayres' case, I have in mind a case which came to me last November with extensive hæmorrhage in the region of the macula and a second hæmorrhage in the neighborhood of the optic disc, neither causing complete loss of light perception. They had occurred without any apparent predisposing cause. The patient was inclined to ascribe the occurrence to exposure to tobacco smoke, which he never could stand. He had been in a room filled with smoke until he suffered from great nausea and discomfort, but had not vomited. He went on the street and coming to a street lamp noticed something wrong with the sight. There has been almost complete recovery with no recurrence of the hæmorrhage in six months, and the man is perfectly healthy in all respects, so far as can be judged by repeated careful examinations.

Dr. S. C. Ayers, Cincinnati:—A curious thing is that so many cases of embolism or thrombosis occur in the morning. Many patients wake up and find the eye blind. This was the case in the three instances which I have reported. I am certain that we have some cases of genuine embolism from the fact that the arteries remain permanently obliterated. In regard to the case reported, I am sure that it could not be embolism. What it was, unless thrombosis with temporary obstruction, I do not know.